MACTEC ENVIRONMENTAL RESTORATION SERVICES, LLC

Spectral Gamma-Ray Borehole Log Data Report

Log Event A

Borehole 30-09-02

Borehole Information

Farm : C	**Tank :** C-109	**Site Number :** 299-E27-97
N-Coord : 43,023	**W-Coord :** 48,285	**TOC Elevation :** 645.17
Water Level, ft :	**Date Drilled :** 6/30/1974	

Casing Record

Type : Steel-welded	Thickness, in. : 0.280	ID, in. : 6
Top Depth, ft. : 0	Bottom Depth, ft. : 100	

Borehole Notes:

This borehole was drilled in June 1974 and completed to a depth of 100 ft with 6-in. casing. The casing thickness is presumed to be 0.280 in., on the basis of the published thickness for schedule-40, 6-in. steel tubing. A drilling log was not available for this borehole; however, information presented in Chamness and Merz (1993) indicates that the borehole was not grouted or perforated. The top of the casing, which is the zero reference for the SGLS, is approximately flush with the ground surface.

Equipment Information

Logging System : 1B	**Detector Type :** HPGe	**Detector Efficiency:** 35.0 %
Calibration Date : 02/1997	**Calibration Reference :** GJO-HAN-13	**Logging Procedure :** P-GJPO-1783

Log Run Information

Log Run Number :	1	**Log Run Date :**	03/28/1997	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	100.0	**Counting Time, sec.:**	100	**L/R :** L **Shield :**	N
Finish Depth, ft. :	49.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a
Log Run Number :	2	**Log Run Date :**	03/31/1997	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	50.0	**Counting Time, sec.:**	100	**L/R :** L **Shield :**	N
Finish Depth, ft. :	20.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a
Log Run Number :	3	**Log Run Date :**	03/31/1997	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	21.0	**Counting Time, sec.:**	100	**L/R :** L **Shield :**	N
Finish Depth, ft. :	12.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

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Borehole # 30-09-02

Log Run Number :	4	**Log Run Date :**	04/01/1997	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	13.0	**Counting Time, sec.:**	100	**L/R :** L	**Shield :** N
Finish Depth, ft. :	0.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Log Run Number :	5	**Log Run Date :**	04/01/1997	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	60.0	**Counting Time, sec.:**	100	**L/R :** L	**Shield :** N
Finish Depth, ft. :	40.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Analysis Information

Analyst : E. Larsen

Data Processing Reference : MAC-VZCP 1.7.9 Analysis Date : 09/30/1997

Analysis Notes :

This borehole was logged by the SGLS in five log runs. Four log runs were required to log the length of the borehole. A fifth log run was performed as an additional quality assurance check on a segment of one of the primary log runs.

The pre-survey field verification spectra for all logging runs met the acceptance criteria established for peak shape and system efficiency, but the post-survey field verification spectra for logging runs one, four, and five failed to meet the acceptance criteria. The energy calibration and peak-shape calibration from the pre-survey field verification spectra were used to establish the channel-to-energy parameters used in processing the spectra acquired during the logging runs.

Casing correction factors for a 0.280-in.-thick steel casing were applied during analysis.

The man-made radionuclides Cs-137 and Co-60 were detected in this borehole. The Cs-137 contamination was detected continuously from the ground surface to 13 ft and 48.5 to 49.5 ft. Isolated occurrences of Cs-137 were detected at 54, 55.5, and 56.5 ft and at the bottom of the logged interval (100 ft). The Co-60 contamination was detected continuously from 48.5 to 58.5 ft and 94.5 to 96.5 ft. A single occurrence of Co-60 was detected at 91 ft.

An analysis of the shape factors associated with applicable segments of the spectra was performed. The shape factors provide insights into the distribution of the Cs-137 and Co-60 contamination and into the nature of zones of elevated total count gamma-ray activity not attributable to gamma-emitting radionuclides.

The K-40 concentrations values increase from 40.5 to 43 ft and increase again from about 49 to 50 ft. The K-40 concentrations remain elevated from 50 ft to a depth of about 70 ft. The K-40 concentration values increase slightly and become variable below 70 ft.

A sharp increase in the U-238 values occurs at about 50 ft. Most of the U-238 concentration data are absent between 53.5 and 56.5 ft.

Additional information and interpretations of log data are included in the main body of the Tank Summary Data

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Report for tank C-109.

Log Plot Notes:

Separate log plots show the man-made and the naturally occurring radionuclides. The natural radionuclides can be used for lithology interpretations. The headings of the plots identify the specific gamma rays used to calculate the concentrations.

Uncertainty bars on the plots show the statistical uncertainties for the measurements as 95-percent confidence intervals. Open circles on the plots give the MDL. The MDL of a radionuclide represents the lowest concentration at which positive identification of a gamma-ray peak is statistically defensible.

A combination plot includes the man-made and natural radionuclides, the total gamma derived from the spectral data, and the Tank Farms gross gamma log. The gross gamma plot displays the latest available digital data. No attempt has been made to adjust the depths of the gross gamma logs to coincide with the SGLS data.

A time-sequence plot of the historical gross gamma log data from 1975 to 1994 is included. The headings of the plots identify the date on which the data in the plots were gathered.

The interval between 40 and 60 ft was relogged as a quality assurance measure to establish the repeatability of the radionuclide concentration measurements. The radionuclide concentrations shown were calculated using the separate data sets provided by the original and rerun logging runs.

Plots of the spectrum shape factors are included. The plots are used as an interpretive tool to help determine the radial distribution of man-made contaminants around the borehole.